ON THE COLUMN DENSITY OF AGN OUTFLOWS: THE CASE OF NGC 5548

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ABSTRACT

We re-analyze the *HST* high resolution spectroscopic data of the intrinsic absorber in NGC 5548 and find that the C IV absorption column density is at least four times larger than previously determined. This increase arises from accounting for the kinematical nature of the absorber and from our conclusion that the outflow does not cover the narrow emission line region in this object. The improved column density determination begins to bridge the gap between the high column densities measured in the X-ray and the low ones previously inferred from the UV lines. Combined with our findings for outflows in high luminosity quasars these results suggest that traditional techniques for measuring column densities: equivalent width, curve-of-growth and Gaussian modeling, are of limited value when applied to UV absorption associated with AGN outflows.

1. INTRODUCTION

Seyfert galaxies often show absorption features associated with material outflowing from the vicinity of their active nuclei at velocities of several hundred km s^{-1} (Crenshaw et al. 1999). These features are traditionally observed in UV resonance lines (e.g., C IV $\lambda\lambda$1548.20,1550.77, N V $\lambda\lambda$1242.80,1238.82, Lyα), but with the improved X-ray spectral capabilities of the *Newton* and *Chandra* satellites, they are also detected in X-ray lines (Kaastra et al. 2000; Kaspi et al. 2000). Reliable measurement of the absorption column densities in these lines are crucial for determining the ionization equilibrium and abundances of the outflows, and the relationship between the UV and the warm X-ray absorbers.

NGC 5548 is one of the most studied Seyfert galaxies, including intensive reverberation campaigns (Netzer & Maoz 1990; Peterson et al. 1991; Korista et al. 1995), line studies (Goad & Koratkar 1998; Korista & Goad 2000), and theoretical modeling (Done & Krolik

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1996; Bottorff, Korista & Shlosman 2000; Srianand 2000). The intrinsic absorber in NGC 5548 was studied in the UV using the *International Ultraviolet Explorer* (Shull & Sachs 1993), the *HST* Goddard High Resolution Spectrograph (GHRS) (Mathur, Elvis & Wilkes 1999) and Space Telescope Imaging Spectrograph (STIS) (Crenshaw & Kraemer 1999), the *Far Ultraviolet Spectroscopic Explorer (FUSE)* (Brotherton et al. 2001), and in X-ray with the *ASCA* (George et al. 1998) and *Chandra* (Kaastra et al. 2000) Satellites. These high quality observations combined with the relative simplicity of its intrinsic absorption features make NGC 5548 a prime target for understanding the nature of Seyfert outflows.

Our work on quasar outflows, has led us to suspect that the current determination of column densities in Seyfert outflows is highly uncertain. In the last few years our group (Arav 1997; Arav et al. 1999a; Arav et al. 1999b; de Kool et al. 2001; Arav et al. 2001) and others (Barlow 1997, Telfer et al. 1998, Churchill et al. 1999, Ganguly et al. 1999) have shown that in quasar outflows most lines are saturated even when not black. We have also shown that in many cases the shapes of the troughs are almost entirely due to changes in the line of sight covering as a function of velocity, rather than to differences in optical depth (Arav et al. 1999b; de Kool et al. 2001; Arav et al. 2001a; we elaborate on this point below). As a consequence, the column densities inferred from the depths of the troughs are only lower limits. Furthermore, it is virtually impossible to decouple the effects of optical depth from those of covering factor for a single line, thus column density determinations in such cases are not possible.

In order to assess the importance of these effects in Seyfert outflows, we reanalyze *HST* high-resolution spectra of NGC 5548. Two such data sets exist in the *HST* archive. 1) GHRS observations including a 14,035 seconds exposure of the C IV intrinsic absorber obtained on 1996 August 24 (spectral resolution of $\approx 20,000$). These data are further described in Mathur, Elvis & Wilkes (1999). 2) STIS echelle spectrum using the E140M grating (4750 seconds exposure), which covers the C IV, N V and Lyα intrinsic absorption features, obtained on 1998 March 11 (full details are found in Crenshaw & Kraemer 1999).

2. ANALYSIS

2.1. Methodology

In studies of ISM and IGM absorption features we implicitly assume that along our line of sight the absorber covers the emission source completely and uniformly. Usually, in these environments this is an excellent assumption since the geometrical size of the absorption clouds are much larger than the emission sources they cover. This assumption allows us to directly convert the depth of the absorption features to optical depth using $\tau = -\ln(I_r)$ (where I_r is the normalized residual intensity in the absorption trough), and

from the optical depth to obtain the column density.

What happens when the complete and uniform covering assumption breaks down? For example let us assume that the absorbing material covers only half of the emission source. In this case even if the optical depth of the absorber is very large (10, 100, 1000...) we would still detect an $I_r = 0.5$. But this I_r would not give us any information about the optical depth. All it can tell us is that half of the light-source's area is covered. Furthermore, this geometrical covering fraction can be velocity dependent. In general, for cases where the line of sight covering of the light-source is not complete, the depth of the trough at any given point will be a convolution of the real optical depth and the covering fraction at that velocity.

To account for partial covering we rely upon doublet lines that yield two related sets of data from which the optical depth and line-of-sight covering fraction can be solved for simultaneously (Barlow & Sargent 1997; Hamann et al. 1997; Arav et al 1999b). For such analysis to succeed we must use unblended absorption features seen in both components of the doublet, where the features are well resolved spectroscopically and possess high enough signal to noise ratio (s/n). To make full use of these advantages we employ a simple robust physical criterion. At each resolution element we require that the real optical depth of the blue component is exactly twice that of the red component, as dictated by the ratio of their oscillator strengths (as is the case for the C IV $\lambda\lambda$1548.20,1550.77 doublet). This is done after normalizing the data and putting the data set for the two transitions on the same velocity scale. The absorption equations are:

$$I_1(v) - (1 - C(v)) = C(v)e^{-\tau(v)} \quad (1)$$

$$I_2(v) - (1 - C(v)) = C(v)e^{-2\tau(v)}, \quad (2)$$

where v is the velocity of the outflow, $I_1(v)$ and $I_2(v)$ are the normalized intensities of the red and blue doublet components, respectively, $C(v)$ is the effective covering fraction (see Arav et al. 1999b), and $\tau(v)$ is the optical depth of the red doublet component. From these two equations we obtain:

$$C(v) = \frac{I_1(v)^2 - 2I_1(v) + 1}{I_2(v) - 2I_1(v) + 1}, \quad \tau(v) = -\ln\left(\frac{I_1(v) - [1 - C(v)]}{C(v)}\right) = -\ln\left(\frac{I_1(v) - I_2(v)}{1 - I_1(v)}\right), \quad (3)$$

where the right most expression for $\tau(v)$ has not appeared in the literature previously. Unlike its predecessor ($\tau(v) = f[C(v)]$), the new expression has a clear physical meaning and behavior, with respect to the data.

We note that this type of analysis can be employed to determine the optical depth of ISM and IGM absorbers as well. In these cases we simply obtain $C(v) \approx 1$ and $\tau(v) \approx -\ln[I_1(v)]$.

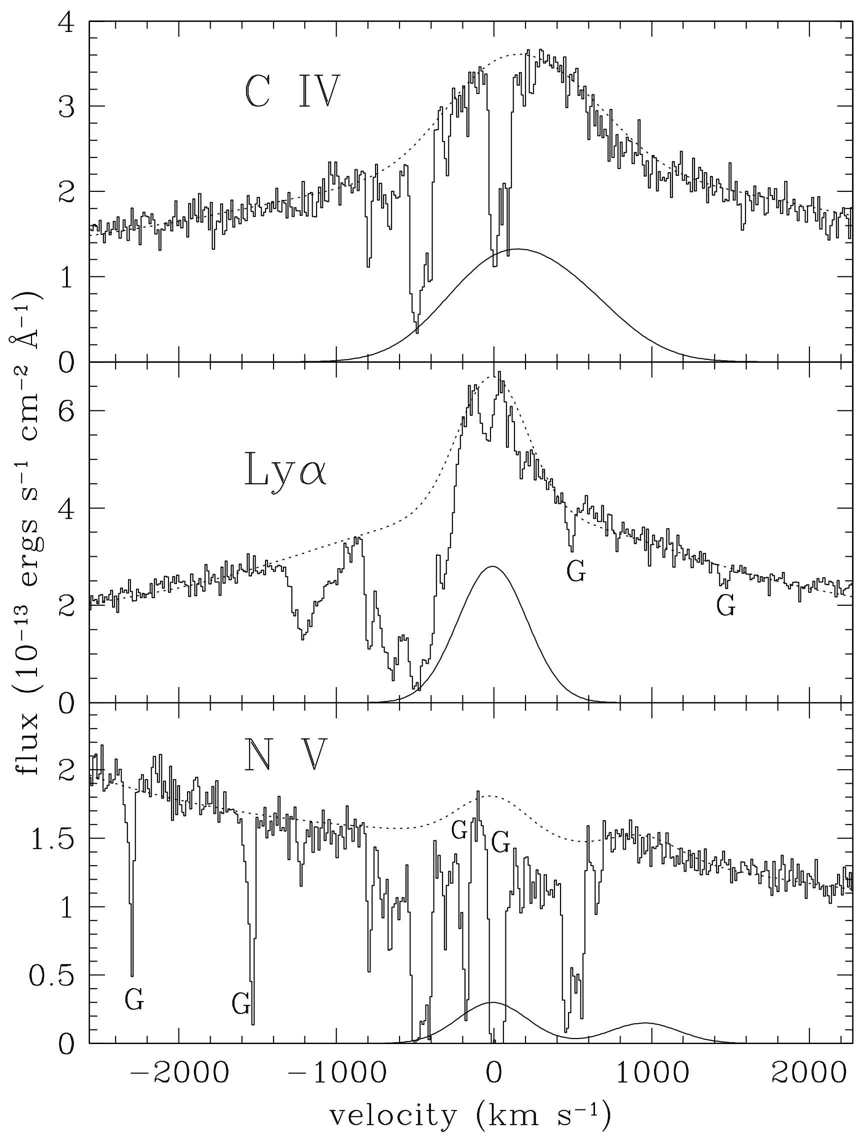

Fig. 1.— *HST*/STIS data of the NGC 5548 outflow as seen in C IV Lyα and N V. The data are boxcar smoothed over 5 pixels. On top of the data we plot our model for the unabsorbed emission. This model contains three contributions, a constant continuum level under the emission line, a broad emission line (BEL) and a narrow emission line (NEL) component. The continuum and BELs are tightly constrained by the data. For the NEL we chose simple one-Gaussian models with the least possible emission excess beyond what the data require, similar in concept to the models chosen by Crenshaw & Kraemer (1999). The NEL models are shown separately at the bottom of the figure. Galactic absorption features are marked by "G."

2.2. What Emission Components Does the Outflow Cover?

In the spectral vicinity of the intrinsic absorber we find emission from three different sources (see Fig. 1). A continuum emission which underlines the entire AGN spectrum, Broad Emission Lines (BELs) with a full width at half maximum (FWHM) of $\sim$ 6000 km s^{-1} and narrow emission lines (NELs) with a FWHM of up to 1000 km s^{-1}(for C IV λ1549). Before attempting to extract the column density from the absorption troughs it is essential to establish which emission components the intrinsic absorber covers. If we assume that the absorber covers all the emission sources when in fact it only covers the continuum and the BEL, we might greatly underestimate the optical depth and hence the column density in the absorption troughs.

To assess which emission components the outflow is covering, we constructed models for the unabsorbed emission for the C IV, Lyα and N V lines (see Fig. 1). Potentially, there is a lot of freedom in such emission models. The centroid redshift of the emission line components can vary between lines and between the NEL and BEL components of the same line, and the considerable amount of absorption makes the NEL model quite subjective (see Mathur, Elvis & Wilkes 1999). In order to minimize the uncertainty we use a simple and restrictive approach while constructing the emission components. We use only Gaussian components, which are all centered on the systemic redshift of the object (z = 0.01717 from the NASA/IPAC Extragalactic Database [NED], based on H I observations). To obtain a physically realistic model, each doublet component in C IV and N V is modeled by separate Gaussian components.

The continuum and BELs are tightly constrained by the data. We obtain a very good agreement with the C IV and Lyα data by modeling both BELs with two Gaussian components characterized by FWHM of 2500 and 8000 km s^{-1}. Two Gaussian components are the minimum number necessary to fit the data. This modeling also agrees well with Brotherton et al. (1994), who argued that most AGN C IV BEL profiles are well fit by two Gaussian components with FWHM of 2000 km s^{-1} and 8000 km s^{-1}. For the NELs we chose single-Gaussian models for each component of the doublet, with the least possible emission excess beyond what the data require, similar in concept to the models chosen by Crenshaw & Kraemer (1999). These models are constructed so no substantial emission features lie above the model, which is a necessary condition for the model to be valid. There are two reasons for choosing a NEL model with the least possible emission excess beyond what the data require. First, it is always possible to choose an emission model that is substantially higher than the data and attribute the difference to absorption. This can be done for all the emission components and for any arbitrary wavelength range. However, the greater the excess emission we invoke the less plausible our model becomes since we have to invoke an increasing amount of unnecessary absorption. Second, as we show below, such models put the most stringent test on the question of whether or not the outflow covers the NEL.

The best fit is obtained with a 660 km s^{-1} FWHM for each C IV component and 430 km s^{-1} for Lyα. For N V, the unabsorbed emission model is dominated by the red wing of the Lyα BEL. This leaves little room for a wide BEL. Instead we used a small BEL component with a FWHM of 2500 km s^{-1} coupled with the maximum allowable NEL with a 430 km s^{-1} FWHM (which is constrained quite tightly by the fit of its red component to the absorption-free data around –1000 km s^{-1}, see Fig. 1). We note that coincidently, Brotherton et al. (2001) modeled the O VI NEL in their *FUSE* data as either a "wide" NEL with FWHM of 658 km s^{-1} or a "narrow" NEL with FWHM of 432 km s^{-1}. From the depth of the strongest absorption features associated with the outflow, we deduce that the outflow must fully cover the BEL and continuum regions. The important issue to resolve is whether the outflow also covers the NEL region.

A decisive way to establish whether the NEL region is covered by the outflow is to find a black (i.e., zero flux) absorption feature on top of the NEL. By inspection of figure 1, this is not the case in NGC 5548. Lacking this definitive test we turn to the next strongest test. By choosing NEL models with the least possible emission excess beyond what the data require, any significant deepening of the troughs below these models necessitates significant coverage of the NEL region by the outflow. From figure 1 we infer that, within the level of noise, in all three lines the troughs do not deepen below the NEL model. A similar situation exists in the *FUSE* data of the O VI $\lambda\lambda$1032,1038 in this object (Brotherton et al. 2001). Although these occurrences are not sufficient to prove the no-NEL-coverage picture, they are strongly suggestive that this is indeed the case. If the NEL region is covered by the flow, it is highly probable that the absorption in at least one of these four lines would be deep enough to categorically show that the NEL must be covered. Furthermore, we point out that in all three lines shown in figure 1, the deepest absorption is very close to the inferred NEL flux level. This is quite a remarkable coincidence if the NEL region is covered. However, this coincidence becomes a natural consequence of a picture where an optically thick outflow fully covers the continuum and the BEL regions, but very little of the NEL region. On the basis of these two arguments we conclude that it is most likely that the outflow covers the continuum and the BEL regions but not the NEL region. In § 2.4 we present further observational support for this picture.

Such a scenario is also plausible on physical grounds. Reverberation studies of NGC 5548 indicate a continuum source whose radius is $\lesssim$ 1 light day, and a C IV BEL region whose luminosity-weighted radius is ∼30 light days (Clavel et al. 1991; Krolik et al. 1991; Korista et al. 1995; Kaspi & Netzer 1999; Korista & Goad 2000). In contrast, the NEL region is larger than ∼10 light years across (Wilson et al. 1989). The very large difference in sizes comfortably allows for a model where the outflow covers most or all of the relatively small continuum source and BEL region, while not covering the hundred times larger NEL region. BeppoSAX observations of NGC 5548 (Nicastro et al. 2000) suggest that the size of the warm absorber is ∼20 light days. Since it is likely that the UV and X-ray absorbers are connected, these findings lend additional support for the no-NEL-coverage picture.

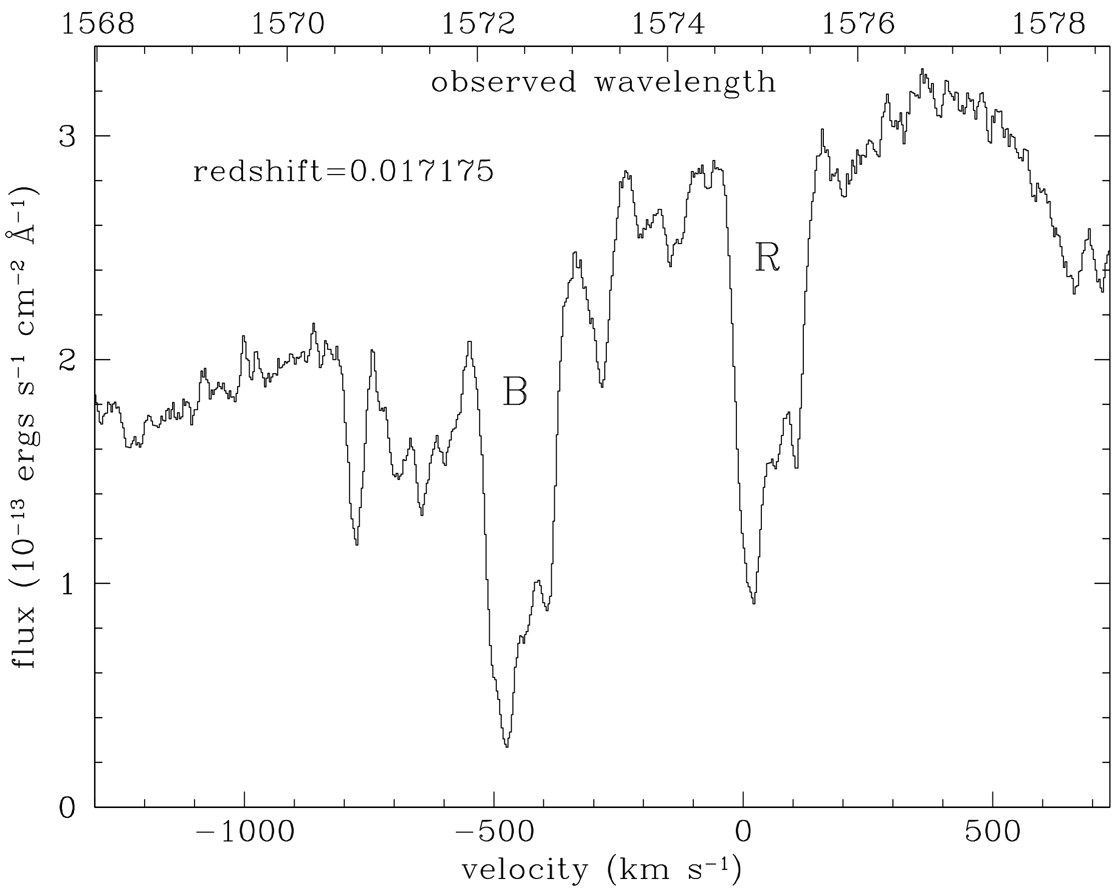

Fig. 2.— *HST*/GHRS spectrum of the C IV λ1549 region in NGC 5548. The data are boxcar-smoothed over 5 pixels. Our analysis in this letter concentrates on the deepest absorption component of the outflowing material, seen in both components of the C IV doublet (marked with B and R for the blue and red components, respectively).

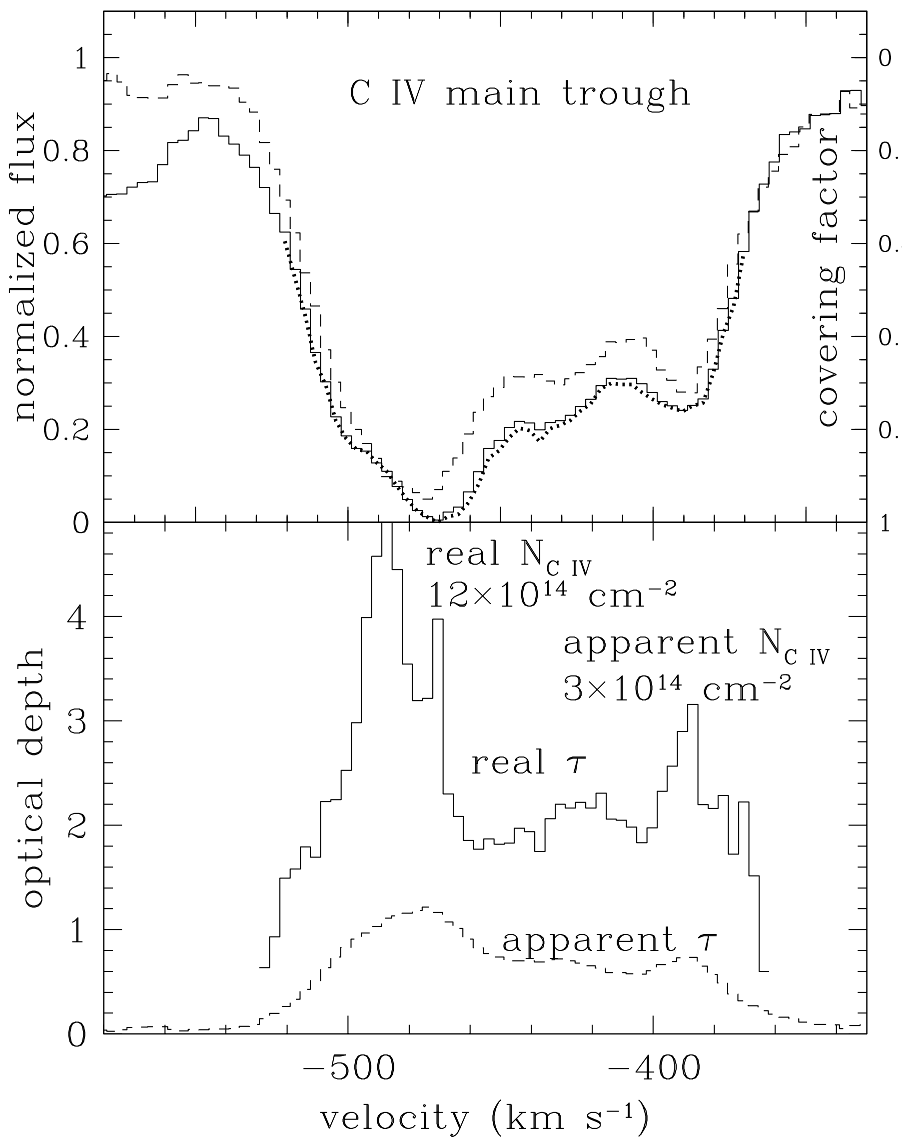

Fig. 3.— Solutions for the covering factor and real optical depth for the case where the narrow emission line is not covered by the outflow. The histograms in the upper panel show the normalized data, for the deepest subtrough in the C IV absorption complex (B and R in Fig 2, boxcar-smoothed over 5 pixels), where the solid and dashed histogram corresponds to the blue and red doublet components. The dotted line is the covering factor solution, which demonstrates that the shape of the trough is determined almost entirely by the covering factor, which is a strong function of velocity. In the lower panel we show the real optical depth, with the apparent one for comparison. The integrated C IV column density is four times larger than the apparent one.

2.3. Optical Depth and Covering Fraction Solutions

Due to their wide spectral coverage, the STIS data discussed above are valuable for trying to determine which emission component is covered by the outflow. However, the s/n of these data is not high enough to obtain clear results with the analysis method described in § 2.1. Luckily, there is another set of high-resolution spectral data of the intrinsic absorber in NGC 5548, with sufficient s/n for the $\tau(v)/C(v)$ analysis. These are *HST*/GHRS data, which show the outflow only in C IV $\lambda\lambda$1548.20,1550.77 (Mathur, Elvis & Wilkes 1999; see Fig 2). We concentrate our analysis on the deepest subcomponent of the outflow, which, due to its depth, is less sensitive to the emission model's uncertainties. This is component number 4 in the Crenshaw & Kraemer (1999) designation. We mark the blue and red subtroughs of this components with "B" and "R" in figure 2.

In figure 3 we show the results of the analysis, which assumes that the NEL is not covered by the flow. The normalized data for this case is given by: $I_r(\lambda) = (F - NEL)/(EM - NEL)$, where F is the observed flux, NEL is the NEL model and EM is the full non-absorbed emission model. In order to derive the optical depth and covering factor functions, we use the same velocity frame for the "B" and "R" subtroughs. This is done by shifting the wavelength of the "R" subtrough to $\lambda_{\rm shift} = \lambda \times 1548.20/1550.77$ and transferring both subtroughs to a velocity presentation using the systemic redshift of the object. Figure 3 shows that the residual intensities in the doublet components do not adhere to the expected 1:2 optical depth ratio (which implies $I_{\rm blue} = I^2_{\rm red}$), but are much closer to a 1:1 ratio. This has two effects: 1) To restore the 1:2 optical depth ratio the covering fraction has to be very close to the $I_{\rm blue}$ curve, which unequivocally demonstrates that the shape of the trough is determined almost solely by the covering fraction at each velocity. 2) Under these conditions, the optical depth is much higher than the apparent optical depth defined as $\tau_{ap} = -0.5 \ln[I_{\rm blue}]$ (see eq. 2), which assumes complete coverage. The comparison between the real and apparent optical depth is shown in the bottom panel. We note that the column density determination for this component in both previous analyses of the GHRS data (2.9×10^{14} cm^{-2}: Crenshaw & Kraemer 1999; 3.6×10^{14} cm^{-2}: Mathur, Elvis & Wilkes 1999) are very similar to the one we extract from the apparent optical depth (3×10^{14} cm^{-2}). However, the column density inferred from the real optical depth solution is 12×10^{14} cm^{-2}. A similar $\tau(v)/C(v)$ analysis of the STIS data yields consistent (albeit noisier) results.

What are the uncertainties in the derived solutions? There are two sources of error in the $\tau(v)/C(v)$ analysis 1) data uncertainties due to the finite S/N in each trough. 2) errors in the unabsorbed emission model. In principle, all three error sources (two for the blue and red troughs data and one for the emission model) should be propagated through equation array (3) in order to derive quantitative error estimates. In practice we find that the systematic uncertainties in the NEL model dominate the total error. The smoothed data we use have a minimum S/N=10 at the bottom of the blue trough and generally a

S/N$\gtrsim$ 20 across most of the extent of both troughs. Since the relative difference between the normalized intensities is mostly 20–30% (see Fig. 3), the errors due to S/N are modest. This can also be inferred from the smooth behavior of the τ solution in Fig. 3.

Estimating the uncertainties in the unabsorbed emission model is much more complicated. Variation in the NEL model affect the red and blue troughs in different ways and there is no physical reason to assume that the NEL model must be Gaussian in nature. We experimented with many NEL models that adhere to the "least possible emission excess" principle and are Gaussian in nature. In general these models gave physical solutions under the no-NEL-coverage scenario i.e., $I_1, I_2 > 0$ and $I_1^2 \leq I_2 \leq I_1$. We estimate that the NEL model uncertainties induce a maximum error of 10% in $\Delta I/I$, over most of the trough. This translates to a 20% error in τ and therefore in our deduced column density. However, in the region of high τ (–500 to –470 km s^{-1}) the error can drive the τ solution to infinity (since it can make $I_2 \geq I_1$). We therefore note that the column density might be significantly higher than the value quoted above. Only significantly improved data will allow us to clarify this issue. For completion we mention that the errors in $C(v)$ are very small due to the mathematical properties of the $C(v)$ solution (see equation array (3)). Whenever I_2 is significantly larger than I_1^2 (but still obeys $I_2 \leq I_1$), $C(v) \approx 1 - I_2$.

We have also solved for the optical depth and covering factor for the case when the NEL is assumed to be covered by the flow. For this case we find that the shape of the trough is still largely determined by variation of the covering factor as a function of velocity, and that the real optical depth is moderately higher than the apparent one. The resultant difference in integrated column density is roughly 50%.

2.4. Additional Support for the Moderate Saturation Picture

Recent *FUSE* observations of NGC 5548 provide an independent indication for saturation in the main absorption trough. These data were taken on June 7 2000 and are described by Brotherton et al. (2001). A direct comparison between the *FUSE* and STIS observation depends on the assumption that the main trough did not vary significantly between the *FUSE* and STIS observing epochs (roughly two years). In the case of NGC 5548, this assumption is supported by noting that the main C IV trough shows very little variation between the STIS and GHRS observing epochs, which also span roughly two years (see § 1).

Assuming no significant variability, a comparison between the *FUSE* observations and the STIS data strongly suggest that the main C IV and O VI troughs are saturated (see Fig. 4). The shape and depth for the main absorption feature is almost identical in both C IV and O VI. Such a coincidence is highly unlikely if the depths of the troughs are due to real optical depth effects. There is no a-priori reason to expect that the optical depth

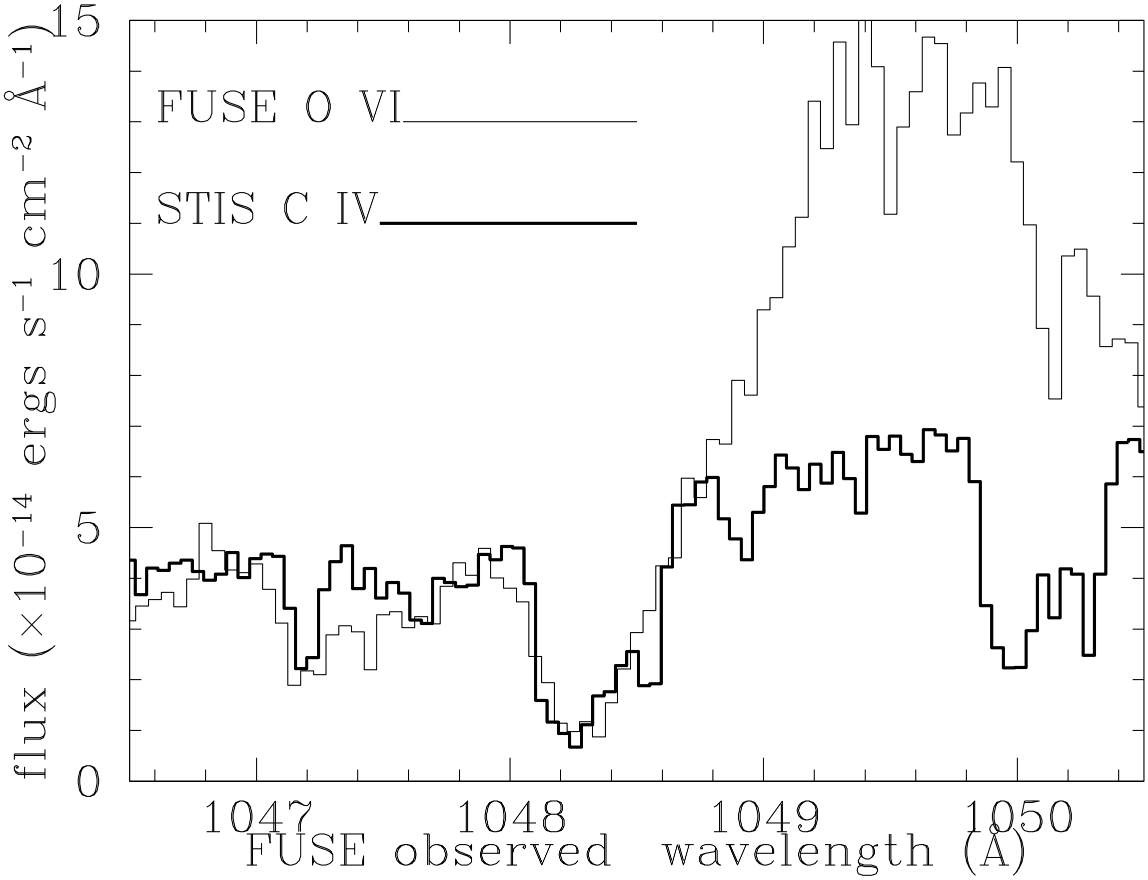

Fig. 4.— A Comparison between the STIS data of the C IV trough and the *FUSE* data of the O VI trough. The blue component of the C IV trough was shifted to the observed frame of the blue component of the O VI data. The flux scaling of the C IV data is designed to match the red wing of the O VI flux level in order to obtain a direct comparison which is not distorted by the very different NELs. The main trough (1048.0–1048.7 Å) is almost identical in shape and depth for both C IV and O VI. This is a powerful and simple indication that both troughs are at least moderately saturated.

of lines that arise from ions with very different ionization potential and from elements with differing chemical abundances, should be almost identical. However, this situation is naturally explained if the shape of the troughs are determined mainly by variations of the covering fraction as a function of velocity. In this case, the optical depth of the C IV and O VI can be quite different but the resulting trough shapes can be very similar. This independent indication for saturation in the C IV trough supports our no-NEL-coverage picture. In order to have the covering factor dominating the shape and depth of the C IV trough, we require the residual intensities of the blue and the red doublet components to be close numerically. This is the case when the NEL is not cover (see Fig. 3), but is not so if the NEL is covered (as can be inferred from Figs. 1 and 2)

3. DISCUSSION

Previously published analyses of the GHRS and STIS data (Mathur, Elvis & Wilkes 1999; Crenshaw & Kraemer 1999) modeled the absorption features as Gaussians, using the software package SPECFIT (Kriss 1994). The possibility of partial covering factor was acknowledged and attempts were made to measure it. However, these analyses neglected two important effects. First, the covering factor can be a strong function of velocity, whereas these studies assumed that it is constant across each absorption component. Second, there is the possibility that the outflow covers the continuum and the BEL, but not the NEL. As our analysis show these two effects are important and have a profound influence on the deduced ionic column densities in the absorption troughs.

The difference between the two approaches stems from a fundamental conceptual issue which is ignored by the Gaussian fitting technique: *each absorption feature is not a single cloud, it is an outflow component*. This is because the absorption components are more than 100 km s^{-1} wide (even thousands in quasar outflows). These cannot be single clouds since, for acceptable photoionization equilibria, clouds' thermal widths are $\lesssim 10$ km s^{-1}. It is reasonable to expect that a cloud will have a single covering factor. However, this is not the situation for an outflow, where the covering factor can be a strong function of velocity. Indeed our analysis of the outflows in QSO 1603+3002 (Arav et al. 2001) and QSO 1044+3656 (de Kool et al. 2001) show precisely this effect. Toy models which illustrate these kinematic/geometric effects are found in Arav (1996) and Arav et al. (1999b). A similar picture arises in global models for the structure of AGN (Elvis 2000; Elvis 2001). Since the absorption components are not single clouds, there is no physical basis for modeling them as such in the form of Gaussians.

In the Seyfert galaxy NGC 5548, as well as for outflows in high luminosity quasars, we have shown that the fundamental quantity of column density can be greatly underestimated if one uses the traditional measuring methods of equivalent width, curve-of-growth and Gaussian modeling. It is rather difficult to modify these techniques to account for the

effects we describe here. The main obstacle is the strong dependency of the covering fraction upon velocity. At this point we do not foresee any way to adequately account for velocity-dependent covering fraction in the traditional methods, without fully solving for it as done here.

What are the implications of the results presented here on our understanding of AGN outflows? Almost all our deductions about the outflows starts from the measured column densities. For example, the existing column density measurements in NGC 5548 coupled with photoionization modeling, suggests that the nitrogen to carbon ratio is significantly higher than solar (Srianand 2000). However, if the C IV column density is much higher than previously thought, the nitrogen overabundance may not be needed. Dynamical models of the winds are also strongly affected since the mass and energy fluxes are proportional to the column densities (Arav, Li & Begelman 1994; Proga, Stone & Kallman 2000). One of the most important implications is in regards to the connection between the UV and the warm X-ray absorber. Based on the existing UV column density measurements it appears that in NGC 5548 the two absorbers cannot arise from the same gas, since the X-ray column densities appear to be a hundred times higher (Kaastra et al. 2000) than those extracted in the UV. (We note that reanalysis of the *Chandra* data using improved calibration, suggest that the equivalent width of the X-ray absorption lines are roughly half of the initial measured values; Nicastro et al. 2001). However, if the UV column densities are strongly underestimated, this situation might change.

Finally, we speculate that the difference of two orders of magnitude between column densities inferred from UV and X-ray observation of intrinsic absorbers might be primarily an illusion. Almost all the intrinsic absorption troughs seen in Seyferts are not black (see Crenshaw et al. 1999). Therefore, their apparent optical depth is $\lesssim 3$. To be detectable in X-ray spectra, troughs must have $\tau \gtrsim 1$ (see Kaastra et al. 2000). Usually it is assumed that the depth of a given trough is indicative of its column density. Therefore, for similar oscillator strength, a similarly shaped trough (i.e., residual intensity as a function of velocity) yields roughly a hundred times higher column density in an X-ray line compared to a UV line simply because its wavelength is hundred times smaller (since $N_{ion} \propto \lambda^{-1}$). This remarkable situation will occur every time we will detect the same trough in both UV and X-rays (e.g., Kaastra et al. 2000). If however, the shape of the UV troughs has little to do with real optical depth, then their column densities can be much higher, averting this unlikely coincidence.

4. SUMMARY

We have reanalyzed the available *HST* high-resolution spectra of the intrinsic absorber in NGC 5548; taking into account the kinematic origin of the troughs. For the highly probable scenario where the outflow does not cover the narrow emission line region we find that:

1. The C IV column density associated with the deepest trough is at least four times larger than previously estimated.
2. The shape of this trough is almost entirely due to changes in the line of sight covering as a function of velocity, rather than to differences in optical depth, similar to our findings for troughs in quasar outflows.
3. Our findings suggest that traditional techniques for measuring column densities: equivalent width, curve-of-growth and Gaussian modeling, are of limited value when applied to UV absorption associated with AGN outflows.
4. We speculate that the large differences in column densities inferred from UV and X-ray detection of the same intrinsic absorption trough, may be primarily an illusion, since the depth of the UV trough is a poor indicator of its real optical depth.
5. In addition, for absorption doublets with 1:2 oscillator strength ratio, we introduce a physically intuitive solution for $\tau(v)$ under the partial covering formalism.

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